

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3104a
MSDS Number: 3104a
SRM Name: Barium Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Barium Standard Solution

Description: SRM 3104a is a single element solution prepared gravimetrically to contain a nominal 10 mg/g of barium with a nitric acid volume fraction of 1 %.

Other Designations: **Barium** in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engravers acid); ***Barium Nitrate** (barium dinitrate; nitrobarite; nitrate of barium; barium (II) nitrate) in **Spectrometric Solution**

Name	Chemical Formulas	CAS Registration Numbers
Nitric Acid	HNO ₃	7697-37-2
Barium Nitrate	Ba(NO ₃) ₂	10022-31-8
Barium	Ba	7440-39-3

DOT Classification: Nitric Acid, Solution UN2031

Manufacturer/Supplier: Available from a number of suppliers

*The addition of barium to nitric acid, along with other intermediate chemical reactions, forms barium nitrate which will precipitate upon evaporation or drying of the solution.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	1	ACGIH TLV-TWA: 2 mg/kg or 5 mg/m ³
		OSHA TLV-TWA: 2 mg/kg or 5 mg/m ³
		Human, Oral: LD _{LO} : 430 mg/kg
Barium Nitrate	1.9	ACGIH TLV-TWA: 0.5 mg/m ³ (as Ba)
		OSHA TLV-TWA: 0.5 mg/m ³ (as Ba)
		Rat, Oral: LD ₅₀ : 355 mg/kg
		Mouse, Intraperitoneal: LD ₅₀ : 293 mg/kg
Barium	1	ACGIH TLV-TWA: 0.5 mg/m ³
		OSHA TLV-TWA: 0.5 mg/m ³
		Rat, Oral: TD _{LO} : 26622 mg/kg/69 wk

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Barium Nitrate	Barium
Appearance and Odor: A white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; pungent odor	Appearance and Odor: colorless or white lustrous crystals	Appearance and Odor: a white, lustrous metallic solid
Relative Molecular Mass: 63.02	Relative Molecular Mass: 261.35	Relative Atomic Mass: 137.33
Density: 1.0543 (10 % nitric acid)	Density: 3.24	Density: 3.51
Solubility in Water: soluble	Solubility in Water: soluble	Solubility in Water: reacts
Solvent Solubility: decomposes in alcohol	Solvent Solubility: slightly soluble in acids	Solvent Solubility: soluble in alcohol

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this barium/nitric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Method Used: N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %): **UPPER:** N/A

LOWER: N/A

Unusual Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires. Barium and barium nitrate are negligible fire hazards when exposed to heat or flames.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure-demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: **X** **Stable** **Unstable**

Conditions to Avoid: Avoid contact with combustible and other incompatible materials.

Incompatibility (Materials to Avoid): Keep nitric acid away from organic materials, plastics, rubber and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide. Barium is incompatible with acids, metals, bases, halogens, halo carbons, and oxidizing materials; barium nitrate should be kept from contact with metals, combustible materials, metal salts, acids, and reducing agents.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or barium nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of barium may release toxic and/or hazardous gases.

Hazardous Polymerization: _____ **Will Occur** **X** **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X **Inhalation** X **Skin** X **Ingestion**

Health Hazards (Acute and Chronic): Nitric Acid: Nitric acid may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Barium and Barium Nitrate: Inhalation may cause irritation of the respiratory tract with sore throat, coughing, and labored breathing. If sufficient amounts are absorbed, symptoms may resemble those of acute ingestion.

Direct contact with barium nitrate compounds to the skin and/or eyes may cause irritation with redness and pain. Application of 500 mg for 24 hours to rabbit skin caused mild irritation. Application of 100 mg of the barium compound for 24 hours to rabbit eyes caused moderate irritation. Repeated or prolonged contact of irritants to the eyes can cause *conjunctivitis*.

The initial effects of ingestion from soluble barium compounds are those of severe gastrointestinal irritation, including nausea, vomiting and diarrhea with or without colic and excessive salivation. There may also be dryness, a sense of constriction of the mouth and throat, and a metallic taste. Systemic effects follow and may include ringing in the ears, dizziness, elevated blood pressure, ocular changes causing blurred vision, and convulsive tremors. Hypokalemia may occur and result in abnormalities of myocardial function and impaired neuromuscular function which may vary from minimal weakness to paralysis. Collapse and death may occur from severe hypokalemia, cardiac arrest, or respiratory failure. Other effects may include anxiety, weakness, and gradually increasing sleepiness with mental confusion. The central nervous system may be the first stimulated and then depressed. Hemorrhages may occur in the stomach, intestines, and kidneys. Kidney damage and kidney failure have been reported. On rare occasions, inorganic nitrates may be converted to nitrites by nitrate-reducing bacteria in the digestive tract resulting in methemoglobinemia.

Medical Conditions Generally Aggravated by Exposure: Nitric acid may aggravate eye disorders, skin disorders, respiratory disorders, and allergies. Barium and barium nitrate may aggravate heart or cardiovascular disorders, respiratory disorders, skin disorders, and allergies.

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	<u> </u>	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	<u> </u>	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	<u> </u>	<u> X </u>

EMERGENCY AND FIRST AID PROCEDURES :

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. Obtain medical assistance.

NOTE: (Nitric Acid): Wash affected skin areas with 5 % solution of sodium bicarbonate (NaHCO₃). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. **DO NOT** give the exposed person bicarbonate to neutralize the material.

TARGET ORGAN(S) OF ATTACK: **Nitric Acid:** skin, teeth, eyes, and upper respiratory tract
 Barium and Barium Nitrate: digestive tract

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in Case Material is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation or destruction.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for non-routine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas. Wash exposed skin areas several times a day with soap and warm water.

NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store this material at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Barium*, September 10, 1998.
MDL Information Systems, Inc., MSDS *Barium Nitrate*, September 16, 1999.
MDL Information Systems, Inc., MSDS *Nitric Acid*, September 16, 1999.
The Merck Index, 11th ed., 1989.
The Sigma-Aldrich Library of Chemical Safety Data, Ed. II, 1988.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified values for this material are given on the NIST Certificate of Analysis.